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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025ACADEMIC YEAR
FIRST YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF SCIENCE
(INFORMATION TECHNOLOGY)

Date: 9th April, 2024
Time: 8:30am –10.30am

KMA 2110 - MATHEMATICS FOR INFORMATION TECHNOLOGY

INSTRUCTIONS TO CANDIDATES

ANSWER **QUESTION ONE (COMPULSORY)** AND **ANY OTHER TWO** QUESTIONS

QUESTION ONE (30 MARKS)

a) Given the following sets $A = \{1, 2, 3, 4, 5, 7, 8, 15\}$ and $B = \{0, 1, 3, 5, 6\}$. Find
- i) $A \cup B$ (1 Mark)
- ii) $A \cap B$ (1 Mark)
- iii) $A - B$ (1 Mark)
- iv) $B - A$ (1 Mark)

b) i) Create a logic gate for the following algebraic expression $\sim (A \wedge B) \vee \sim C$. (3 Marks)

ii) hence create its truth table. (4 Marks)

c) Draw a graph having the following matrix as its adjacency matrix.

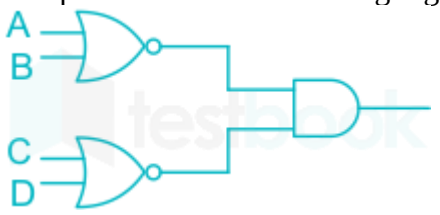
$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

(3 Marks)

d) Find the derivative of the following functions:
- i) $y = (x^2 - 1)^3$ (2 Marks)
- ii) $y = \frac{x^4 - 2x + 1}{x^2}$ (2 Marks)
- iii) $y = (x + 3)(3x^3 - 4x)$ (2 Marks)

e) Determine the power set $P(A)$ of the set $A = \{1, 2, a,\}$. (3 Marks)

g) Write the algebraic expression for the following logic gate diagram



(2 Marks)

h) Evaluate the following integrals:
- i) $\int (x^3 + 2x - 1)dx$ (2 Marks)

ii) $\int_{-1}^{2}(2x^4 - x^2 + 5)dx$ (3 Marks)

QUESTION TWO (20 MARKS)

a) Safaricom (Kenya Ltd) surveyed 400 of its customers to determine the way they learned about the new Jibambie tariff. The survey shows that 180 learned about the tariff from radio, 190 from television, 190 from newspapers, 80 from radio and television, 90 from radio and newspapers, 50 from television and newspapers, and 30 from all three forms of media.

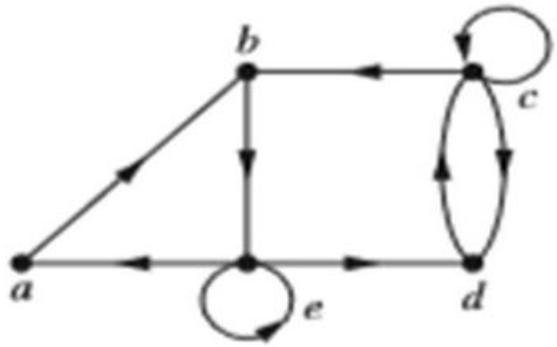
i) Draw a Venn diagram to represent this information. (4 Marks)

ii) Determine the number of customers who learned of the tariff from at least two of the three media. (2 Marks)

iii) Determine the number of customers who learned of the tariff from exactly one of the three media. (2 Marks)

iv) Determine the number of customers who did not learn of the tariff any of the three media. (2 Marks)

b) Determine the adjacency matrix for the following directed graph.



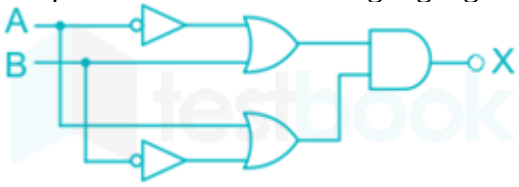
(6 Marks)

c) Determine the degree of each of the vertex in the following graph

(4 Marks)

QUESTION THREE (20 MARKS)

a) (i)Write the algebraic expression for the following logic gate diagram



(4 Marks)

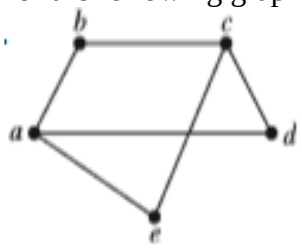
(ii)Create the truth table for the algebraic expression obtained in part (i). (4 Marks)

b) Draw the graphs having the following matrices as its adjacency matrices.

i) $\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ (4 Marks)

ii) $\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & 1 \\ 0 & 1 & 1 & 0 \end{bmatrix}$ (4 Marks)

c) Determine the adjacency matrix for the following graph



(4 Marks)

QUESTION FOUR (20 MARKS)

a) Find the derivatives of the following function:

i) $f(x) = x^{-2} + 5x + 1$ (2 Marks)

ii) $y = (x^3 + 1)(x^2 + 2x - 3)$ (3 Marks)

iii) $y = \frac{x^2 - 3x + 6}{x^2}$ (2 Marks)

iv) $f = e^x(2x^2 + 1)$ (2 Marks)

v) $y = \ln(x^2 + 2)$ (2 Marks)

vi) $fy = 5x^3 \sin x$ (2 Marks)

vii) $f(x) = \frac{\cos x}{4x^2}$ (2 Marks)

b) Find the points of extrema of the following functions and sketch their graphs

i) $f(x) = -x^2 + 5x + 6$ (2 Marks)

ii) $f(x) = x^3 - 3x^2$ (3 Marks)

QUESTION FIVE(20 MARKS)

a) Two bodies started moving at the same time from the same point in the same direction along a straight line. The first body moves with velocity $v = (6t^2 + 2t)m/s$ while the second with the velocity $v = (4t + 5)m/s$. What will be the distance between the bodies in 5 seconds? (3 Marks)

b) Evaluate the following integrals

i) $\int \frac{6x^2 - 2}{(x^3 - x + 1)} dx$ (3 Marks)

ii) $\int e^x \sin x \, dx$ (3 Marks)

iii) $\int (x^4 - 6x + 4) dx$ (2 Marks)

iv) $\int 3x^2 e^{x^3 - 3} \, dx$ (3 Marks)

v) $\int (2x + 1)^4 dx$ (3 Marks)

vi) $\int x \sin x \, dx$ (3 Marks)